PATENT ABSTRACTS OF JAPAN

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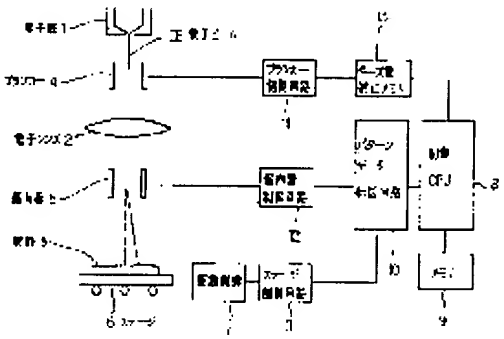
(54) FORMATION OF PATTERN BY CHARGED-PARTICLE-BEAM LITHOGRAPHY

(57)Abstract:
PURPOSE: To form an accurate pattern by remarkably reducing an influence, on the line width of a pattern, which is caused in each process after a drawing operation.
CONSTITUTION: A material 3 to be drawn regularly is placed on a stage 6; a piece of data on a pattern to be drawn on the material is read out by using a CPU 8 from a memory 9; the piece of data is supplied to a pattern-data transfer circuit 10. When, in a regular drawing operation, a blanking signal is sent to a blanker control circuit 14 via a dose-amount correction memory 13, it is corrected according to a value stored in the dose-amount correction memory 13. That is to say, a dose amount is changed in each field according to the value stored in the dose-amount correction memory 13, and the drawing operation is performed over the whole face of the material 3. After all drawing operations have been finished, the material 3 is taken out form an electron-beam lithography apparatus, various processes including a development process are executed and the pattern is formed.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention is the manufacture process of a semiconductor device etc., and relates to the pattern formation method by charged particle beam drawing which forms a pattern based on pattern drawing on a drawn material by the electron beam or the ion beam.
[0002]
[Description of the Prior Art] In the manufacture process of a semiconductor device, drawing which used the electron beam and the ion beam for formation of a detailed pattern is used. For example, a resist is applied on the glass plate with which the metal membrane was prepared in the front face, and a predetermined pattern is drawn with an electron beam from on the. After this drawing is completed, as for a drawn material, the metal membrane of a desired pattern is formed on a glass plate through development process, ashing process, ETCHINGUA process, etc.
[0003]
[Problem(s) to be Solved by the Invention] By the way, when the line breadth was investigated about the pattern finally formed, it changed delicately for every place of material, and it became clear to have the specific distribution which is in a material side. Resist thickness crosses all over material and the fact not uniform, that the core of material differs in the property of an ashing device or an etching system from a periphery, that resist sensitivity has the distribution in a material side, etc. is cited as the cause. Therefore, in an electron beam lithography, however it may perform exact pattern drawing with a sufficient precision, as for the pattern finally formed, the line breadth will be different for every place within a material side.

[0004] this invention was made in view of such a point, and the purpose lessens influence to the line breadth of the pattern resulting from each process after drawing remarkable, and is to realize the pattern formation method by charged particle beam drawing which can form an exact pattern.
[0005]
[Means for Solving the Problem] The pattern formation method by charged particle beam drawing based on this invention In the pattern formation method by charged particle beam drawing which uses a charged particle beam for a drawn material by which the resist was applied to the front face, draws a pattern, and formed the predetermined pattern through processes, such as a development, after that Change of the line breadth of the pattern resulting from the aforementioned process in each field of a drawn material is measured beforehand. Based on this measured variation, it is characterized by performing charged particle beam irradiation into a drawn material by the dose which negates this change for every field of a drawn material at the time of pattern drawing by the charged particle beam.
[0006]
[Function] Beforehand, the pattern formation method by charged particle beam drawing based on this invention measures change of the line breadth of the pattern in each field of a drawn material, and performs charged particle beam irradiation into a drawn material based on this measured variation by the dose which negates this change for every field of a drawn material at the time of pattern drawing by the charged particle beam.
[0007]
[Example] Hereafter, with reference to a drawing, the example of this invention is explained in detail. Drawing 1 shows an example of the electron-beam-lithography system for enforcing the method based on this invention, and 1 is an electron gun. Electron beam EB generated from the electron gun 1 is irradiated on the drawn material 3 by the electron lens 2. Along with the optical axis of electron beam EB, the deflecting system 5 for deflecting BURANKA 4 and an electron beam according to a drawing pattern etc. is arranged. Although the drawn material 3 is laid on the stage 6, a stage 6 is moved to X and Y both directions with the drives 7, such as a motor, by it. 8 is the control CPU which controls each component, and CPU8 supplies the drawing data from memory 9 to the pattern data transfer circuit 10. The pattern data transfer circuit 10 generates the move signal of a stage, the deviation signal of an electron beam, and the blanking signal of an electron beam according to the supplied pattern data. A stage move signal is sent to the stage control circuit 11, and the stage control circuit 11 controls the stage drive 7 based on the signal. The deviation signal of an electron beam is supplied to the deflecting system control circuit 12, and the deflecting system control circuit 12 impresses the deviation signal according to the supplied signal to deflecting system 5. The blanking signal of an electron beam is supplied to the BURANKA control circuit 14 through the dose amendment memory 13, and the BURANKA control circuit 14 impresses the blanking signal according to the supplied signal to BURANKA 4. Operation of such composition is explained below.
[0008] First, although the drawn material 3 is carried on a stage 6, this material is for example, a glass plate, vacuum deposition of the chromium is carried out on it, and the resist is further applied on it. And drawing of a predetermined test

pattern is performed to the whole surface of this material. CPU8 reads drawing test pattern data from memory 9, and this drawing is performed by sending the pattern data to the pattern data transfer circuit 10. That is, the signal of movement of a stage is supplied to the stage control circuit 11 from the pattern data transfer circuit 10, and the stage control circuit 11 and a drive 7 move a stage 6 the whole field of drawing based on the signal. Whenever a stage 6 is moved for every field, the deviation signal of the electron beam according to the drawing test pattern is supplied to the deflecting system control circuit 12, and the blanking signal of an electron beam is supplied to the BURANKA control circuit 14, and test pattern drawing by the electron beam is performed to material 3. After drawing of the test pattern across which it goes all over material 3 is completed, material 3 is taken out from a drawing system and a development is given. And the Usher processing and etching processing will be performed and the test pattern of chromium will be formed on a glass plate.

[0009] Next, the material in which the test pattern of chromium was formed is introduced into the line breadth measuring machine (not shown) using the electron beam as a sample, and the length of the line breadth of the test pattern which crossed all over the sample and was formed is measured. And when the same pattern is formed for every field as a test pattern, the average of the line breadth of a pattern is calculated for every field, for example. The averages of the pattern width of face for every field of this differ for every place of material. This cause is based on each process in accordance with an electron beam lithography, as described above. By the way, there is a relation to the line breadth and the amount of dosages of electron beam of a pattern which were formed of the electron beam lithography to which the line breadth of a pattern becomes thick as are shown in drawing 2 and a dose increases. CPU8 calculates optimal dose from which the line breadth for every place of material 3 turns into desired line breadth by passing through each process from this phenomenon and the variation of the line breadth in every place of said material. Drawing 3 is the amendment table of a dose called for by doing in this way, and length and the width of each value of this table are the correction value from the criteria dose of every field (field) of a respectively. From CUP8, the table of this drawing 3 is sent to the dose amendment memory 13, and is memorized.

[0010] After such work is done, the material 3 which should draw regularly is carried on a stage 6, and the data of the pattern which should draw into this material are read from memory 9 by CPU8, and are supplied to the pattern data transfer circuit 10. Although this regular drawing is performed like drawing of said test pattern, in case a blanking signal is sent to the BURANKA control circuit 14 through the dose amendment memory 13, at the time of regular drawing, it is rectified according to the value memorized by the dose amendment memory 13. For example, when the correction value in a certain field is 0, blanking time of an electron beam is made into an allowed time, and let the amount of dosages of electron beam be a standard dose. moreover, if the correction value in other fields is 1 or 2, blanking time of the electron beam in the case of drawing in the field will be lengthened -- having -- the amount of dosages of electron beam -- 1 from a standard dose -- or it is made [many] 2 ******s Thus, according to the value memorized by the dose amendment memory 13 for every field, change, i.e., a dose, is changed to the blanking time of an electron beam, and drawing across which it goes all over material 3 is performed. After all drawing is completed, material 3 is taken out from an electron beam exposure system, the various processes which made development the start are performed, and formation of a pattern is performed. Under the present circumstances, in the place where line breadth becomes narrow according to each process, since the amount of dosages of electron beam is beforehand made [many], change of the line breadth by the process can be negated with the amount of dosages of electron beam, and it can go across it all over a sample, and it can form an accurate pattern. On the contrary, in the place where line breadth becomes large according to a process, the amount of dosages of electron beam is lessened beforehand.

[0011] Although this invention was explained above, this invention is not limited to the above-mentioned example. For example, although the electron beam lithography was explained to the example, this invention is applicable also to ion beam drawing. Moreover, although the correction value of a dose was calculated for every field, the correction value of a dose can also be calculated still more finely and the correction value of a dose may be conversely calculated for two or more fields of every.

[0012]

[Effect of the Invention] As explained above, the pattern formation method by charged particle beam drawing based on this invention Change of the line breadth of the pattern resulting from processes, such as a development in each field of a drawn material, is measured beforehand. Since it was made to perform charged particle beam irradiation into a drawn material by the dose which negates this change for every field of a drawn material at the time of pattern drawing by the charged particle beam based on this measured variation Influence to the line breadth of the pattern resulting from each process after drawing can be lessened remarkable, and an exact pattern can be formed.

[Translation done.]